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(54) Title: COMPUTER IMPLEMENTED MARKETING SYSTEM

(57) Abstract

    A state-event engine manages behavior over time in response to events in deterministic fashion from user-supplied rules and policies for a set of dynamic objects. The campaign engine (20) selectively generates and stores a campaign population, representing different types of marketing campaigns. A collection of dynamic object data stores maintains data on the corresponding marketing agent population, resource population, and listing population. A matching process orders members of the listing populations based on the target of at least two members of the campaign population such that a set of offers to buy and offers to sell the same resources is created. A prediction engine (22) processes historical data to predict how campaigns can best match buyer (32) to seller (34). Software agents negotiate on behalf of buyer and seller identify potential deals. The system is capable of being implemented using computer network and web-based technology.

COMPUTER IMPLEMENTED MARKETING SYSTEM

Background and Summary of the Invention:

The present invention relates generally to computerized
business management systems. More particularly, the invention
5   relates to an electronic commerce marketing system that automates
and optimizes the behavior of inbound and outbound marketing
campaigns on behalf of each of several different parties seeking to
exchange valuable resources. The optimization takes places over
time as the system learns from previous results allowing such
10 campaigns to tune themselves. In one embodiment, the computer-
implemented system employs an optimization engine utilizing genetic
algorithmic and game theory techniques augmented by a prediction
engine that uses holographic neural network techniques. Although
the system is well adapted and described in the context of a single
15 family residential real estate marketing system, it may be readily
adapted to for use in other businesses, as well.

The real estate industry has traditionally relied heavily on
social contact (word of mouth) and comparatively simple advertising
campaigns, all relying heavily on the interpersonal skills of the
20 real estate company's agents. Although computer technology has
been used to automate the collection and distribution of real
estate multiple listing information, very little else has been done
to improve the information infrastructure of the real estate
business as a whole. Other industries, primarily those involved in
25 direct business-to-business marketing, have begun to use computer
systems to automate the marketing process. However, existing
marketing computer systems have been designed to facilitate
complex, multi-person sales activity between manufacturers and
their customers and do not work very well in consumer markets such
30 as the real estate market. On the other hand, current consumer
marketing systems such as contact management systems, telemarketing
systems, and mail order processing systems do not begin to address
the more sophisticated aspects of real estate marketing. In any
event, current business-to-business marketing systems and consumer
35 marketing systems all suffer from similar common weaknesses: they
either present no means for improving efficiency over time, or they
place the burden of improvement on user-supplied rules which
require trial-and-error experiments and separate ad hoc analysis of
the results of those experiments.

40   To illustrate, consider some of the issues faced by the
residential single family home real estate brokerage firm. First,
for most people, the home is the most substantial asset they will
ever own. The decision to buy or sell a home is an emotional one
and many people will understandably take a long time to mentally
45 commit that they are ready to buy or sell. Then, even if their
home buying or selling readiness is high, there is the issue of
locating a suitable property, obtaining financing, finding a buyer
for a person's existing property, and so forth. All of these
emotionally fraught uncertainties make the real estate business

highly labor intensive. It has heretofore been very costly and
inefficient to locate ready buyers and sellers using conventional
mailing lists and telemarketing campaigns. Simply stated, there
has heretofore been no way to predict which members of the
5   potential customer population represent good leads on which to
follow up.
    As noted, real estate brokerage companies have traditionally
relied heavily on their real estate agents to meet the potential
customer population face to face, to identify the best buyer and
10 seller candidates.   This presents a significant problem for
brokerage firms that are trying to increase market share while
protecting profit margins.   In this labor-intensive industry,
increasing market share has traditionally required increasing the
number of agents. Increasing the number of agents does not
15 translate to increased productivity and efficiency since after a
point the best agents have already been taken; in fact, increasing
the number of agents can actually reduce efficiency. What is needed
is a means to increase the overall efficiency of the entire
marketing process for the broker, the agents and the public.
20   The present invention applies a highly sophisticated, computer-
implemented system to this consumer marketing problem. Used
properly over time, the computer-implemented system can re-engineer
much of the marketing side of the business. Although the presently
preferred embodiment is adapted to the residential single family
25 home aspect of the real estate marketing business, the system
described herein can readily be adapted to other types of
businesses, particularly those involved in consumer marketing with
a sales force.
    According to one aspect of the invention, a computer-
30 implemented, self-optimizing marketing system is provided.   A
campaign engine selectively generates and stores a campaign
population, that is, a plurality of individual marketing campaigns,
each campaign characterized by a plurality of campaign attributes.
Campaigns can be created on behalf of a broker (e.g. via a broker
35 employee), a member of the public (e.g. actual or potential buyers
and sellers of properties) or agents (i.e. real estate sales
associates).   Campaigns perform useful work on behalf of the
sponsor, typically oriented to fulfilling desires to utilize,
incorporate, exchange, access or monopolize resources in a more
40 automated and efficient way than would be possible for the sponsor
to do otherwise. By way of example, the campaign population might
include inbound campaigns that manage the leads generated by
members of the public calling a broker's hotline to learn about
properties for sale in that market. The campaign population might
45 also include outbound campaigns to manage the process of finding
the optimum candidates to receive direct mail about a property or
seminar. Each of the specific campaigns in the campaign population
is differentiated from other campaigns by their respective campaign
attributes. The system also includes a data structure for the
50 storage and retrieval of various campaign data including; the
campaign's sponsor, the desires of that sponsor in terms of

specific resources, and rules or constraints (e.g. time, money) on how to optimally meet those desires. The marketing systems provides for a feedback loop between outbound campaigns and inbound campaigns such that the results of inbound campaigns can be used to
5   monitor and improve the effectiveness of outbound campaigns.

The marketing system further includes a data store for storing a person population, property population, agent population and a broker population. Such populations may include both actual and potential members (i.e. actual customers and potential customers in
10 the person population, actual agents and potential agents in the agent population, etc. The person population consists of individual members, each comprising stored data that represents a plurality of current customers, past customers and non-customers adding up to all members of a market's total adult population. The members of
15 the person population are each characterized by a plurality of person attributes. In the presently preferred embodiment, the person attributes would include suitable identifying information, allowing those members of the person population to be contacted. In the preferred embodiment, the person attributes also include
20 quantitative attributes that indicate each (non-customer) member's readiness to enter the market and the desires of that member regarding properties on the market, currently or in the future. Similarly, the agent population consists of individual members, each comprising a plurality of agents or potential agents who
25 themselves are characterized by a plurality of agent attributes, including actual or predicted quantitative attributes regarding an agents sales productivity, areas of specialization and market areas served. The property population for a particular market is fully represented in the data store with plurality of actual properties
30 and potential properties (e.g. sub-developments with unsold lots, etc). The property attribute data includes previous sales history, current sales status (from multiple listing service data, summary and detail of accumulated inquiries by potential customers regarding the property and (for properties not yet up for sale)
35 calculated probability of that property coming into the market soon, as well as predicted days-on -market. The broker population consists of one or more brokers whose attribute data include compensation plans for agents, available services, fees and costs for those services, sets of roles for employees, defined trading
40 areas and various marketing assets.

The marketing system further includes an optimization engine that accesses campaign data, person data, property data, agent data and broker data. The optimization engine utilizes a scoring process for ordering the members of a particular population. The scoring
45 process employs an adaptive scoring algorithm that alters the scores based upon relations among at least some of the campaign attributes and person, property, broker, or agent population member attributes. Scores are used to compete for scarce resources by way of an exchange process that itself comprises an optimization
50 engine. This competition creates the desired optimization for the campaign. By way of example, members of the public who call the

broker's hotline are treated by the inbound hotline campaign as
potential lead. These potential leads enter the exchange process
with particular scores that are used to allow those potential leads
to compete for slots in the following day's call queue for outbound
5   telemarketing. A formal bidding process takes place whereby the
call queue slots bid for the best leads using rules specified to
the governing inbound and outbound campaigns by the user. In
addition, the campaign includes a set of policies that ensures that
the overall call queue is also optimized to a desired level not
10 just individual slots (that is, the total set of filled slots in
the call queue meets some objective function as well as the
individual slots). Leads that do not make it for that day's call
queue are recycled into the next day's competition by being allowed
to re-enter the next day's exchange process. In this way, the
15 optimization engine continuously tunes itself to better achieve the
desired goals of the appropriate inbound and outbound marketing
system campaigns.

   The marketing system also includes a prediction engine that
accesses the data structures to issue predictions based on
20 historical data. The prediction engine can be used to complement
the key values generated from user-specified rules. Continuing with
the example begun in the previous paragraph, leads obtained via an
inbound hotline campaign are assigned a home buying or selling
readiness state using rules specified in the campaign by the user.
25 The prediction engine also issues its own predicted home buying or
selling Readiness State for each lead. As more and more historical
data is developed, the predicted states become more accurate than
the ones generated by the user's rules. The exchange process begins
to weigh the predicted states as more important than the user-
30 specified, rule-generated states. The system provides for
additional tuning of marketing campaigns in ways that extend beyond
the initial rules provided by users. Thus, campaigns actually
evolve and become more effectiveness over time.

   In another aspect of the invention, the computer-implemented
35 real estate marketing system facilitates commerce between real
estate agents, members of the public and one or more real estate
brokers. The system includes a campaign engine for selectively
generating a plurality of marketing campaigns characterized by a
plurality of stored campaign attributes. The campaign engine has
40 several interfaces by which different users may interact with the
system and by which different kinds of information can be input to
and read from the system. These interfaces include an agent
interface by which real estate agents may specify rules to be
reflected in at least one marketing campaign, and by which real
45 estate agents may receive leads representing selected members of
the public. The system also includes a broker interface by which a
real estate broker may specify rules to be reflected in at least
one marketing campaign and by which selected ones of the stored
campaign attributes may be communicated to the broker. Finally,
50 the system includes a public interface whereby potential or
existing customers may create campaigns to manage services to meet

their needs to buy or sell properties and obtain agents to
represent them in these transactions. The same system unites and
optimizes the needs of all three classes of participants via the
campaign engine, the optimization engine and the prediction engine.
The broker can create campaigns that interact with agents or
members of the public or other brokers. Agents can create campaigns
to interact with other agents or the public or one or more brokers.
Members of the public can create campaigns to interact with each
other or agents or brokers. The computerized marketing system can
provide these capabilities within one market or across many
markets.

     In yet another aspect, the invention provides a customer
acquisition and retention system (CARS) and an object-oriented
business computer-implemented modeling framework that may be used
to construct such system. The object-oriented framework implements
a computer-implemented database model that is' well suited to a
variety of different platforms, including relational database
platforms. The framework includes market agents that encapsulate a
plurality of attributes and operations performed by legal entities
(e.g. persons using the system) and computer agents. The framework
also defines a property (e.g., real estate, goods) and service
object model that encapsulates attributes and operations associated
with properties and services administered by the system. The
framework further defines a campaign object model that encapsulates
attributes and operations associated with campaigns (e.g. marketing
campaigns) that are orchestrated to achieve predetermined
objectives. In addition to the above components, the framework also
includes further object models to represent listings and deals
involving the property or services administered by the system, and
an object model to represent geographic and demographic
information.

     For a more complete understanding of the invention and its many
advantages, refer to the following specification and to the
accompanying drawings.

                    Brief Description of the Drawings:

     Figure 1 is a top-level entity relationship diagram depicting
the system architecture of a presently preferred embodiment of the
marketing system of the invention;
     Figure 2 is a data flow diagram of the embodiment of Figure 1,
showing additional details about each of the major components of
the preferred embodiment;
     Figure 3 is a use case diagram of a simple embodiment of the
marketing system, illustrating how the invention might be employed
in a typical residential real estate brokerage environment;
     Figure 4 is is a detailed data flow diagram showing how
referral data is generated and processed by the software components
of the system;

Figure 5 is a top-level block diagram view of a business
modeling framework, useful in understanding the concepts that may
be employed in developing a preferred embodiment of the marketing
system;

5   Figure 6 is a mid-level block diagram view of a business
modeling framework, illustrating further details of how a preferred
embodiment of the marketing system may be constructed;

Figures 7 and 8 are event trace diagrams illustrating the
referral generation process and the inbound call handling process,
10   respectively;

Figure 9 is a hardware implementation block diagram showing one
possible hardware configuration for implementing the marketing
system;

Figure 10 is an object model for the MarketAgent package
15   employed by the presently preferred CARS framework;

Figure 11 is an object model for the Property and Service
package employed by the presently preferred CARS framework;

Figure 12 is an object model for the Campaign package employed
by the presently preferred CARS framework;

20   Figure 13 is an object model for the Listing and Deal package
employed by the presently preferred CARS framework;

Figure 14 is an object model for the Region package employed by
the presently preferred CARS framework;

Figure 15 is an object model for the BusinessElement package
25   employed by the presently preferred CARS framework;

Figure 16 is an object model for the State Model package
employed by the presently preferred CARS framework;

Figure 17 is an object model for the addressable object package
employed by the presently preferred CARS framework; and

30   Figure 18 presents a summary explanation of the OMT object
modeling notation used in some of the figures.

Description of the Preferred Embodiment:

The presently preferred system architecture for the
35   computerized marketing system of the invention is illustrated in
Figure 1. Figure 1 is an entity relationship diagram that
illustrates some of the major components of the system.

At the heart of the system is the campaign engine 20, which
uses a prediction engine 22 and an optimization engine 24. The
40   campaign engine provides several interfaces by which users of the
system interact with the engine. The preferred implementation
identifies three classes of users; and three user interfaces are
provided. The classes of users include a broker population 26, an
agent population 28, and a public population 30. As illustrated,
45   the system distinguishes among members of the public as being part
of the (actual or potential) buyer's population 32 or the (actual
or potential) seller's population 34.

Brokers 26 communicate with the campaign engine through the
broker interface 36. The agent population 28 communicates with the
50   campaign engine 20 through agent interface 38. In the preferred

embodiment certain information concerning the public population may
be supplied to the campaign engine by the real estate broker, by
the real estate agents, or by the marketing system designer as a
set of initial data upon which the system optimizes. If desired,
5 these data may be input through public interface 40 as well. In
this context, the designation "public" interface connotes that the
data are about members of the public, and not necessarily furnished
directly by members of the public. However, the preferred
embodiment also allows members of the public to interact with the
10 campaign engine through public interface 40. As will be discussed
below, the marketing system of the invention is designed to develop
different marketing campaigns (outbound) and then harvest data
about the responses to those campaigns (inbound). If desired, the
marketing campaigns may include direct interaction with members of
15 the public. Examples include websites on the Internet, computer
monitoring of telephone hotlines, data entered through
questionnaires at open houses, user interaction with electronic
kiosks, and the like.

Referring to Figure 2, a data flow diagram of a preferred
20 implementation is illustrated. This diagram serves to clarify the
concepts outlined in Figure 1. Each of the user interfaces
discussed in the previous section is implemented in the form of a
"virtual agent" through object-oriented software. Rather than a set
of general menus or functions, each user has a customized personal
25 software agent provided by the system to meet their needs. More
specifically the broker interface 36 at a minimum is comprised of a
virtual marketing director object 54 and a virtual customer service
representative object 63; each serves as the broker's alter ego in
communicating with the campaign engine. Likewise, the agent
30 interface 36 is comprised of a virtual personal assistant object 58
that communicates with campaign engine 20 on behalf of the real
estate agents. The virtual personal assistant automatically
handles many functions currently handled by human assistants hired
by real estate agents. The public interface 40 is comprised of a
35 virtual agent object 62 which allows potential or existing
customers to manage campaigns in order to obtain a subset of the
services provided by actual licensed real estate agents. These
virtual worker interfaces allow brokers 26, the public 30 or agents
28 to create and manage campaigns 50 via providing rules, targets
40 and budgets to the campaign process 51. In return, referrals (names
of potential customers) are provided to agents. Desired properties,
agents or services are returned to the public. Qualified potential
agent recruits or customer leads to the broker. In every case this
is achieved via a scheduling process 72 and a contacting process
45 75.

The campaign engine 20 itself is then comprised of at least one
instance of the campaign management process 51 managing at least
one instance of a campaign within a campaign data store 50. As
illustrated, the prediction engine 22 and the optimization engine
50 23 access the campaign data store 50 and are managed by the
campaign management process 51. In addition, campaigns 50 may

populate a desire data store **66** with potential or existing
customer's desires for types of properties from a property store
70, agents and services from a person store **68** or properties,
neighborhoods, or communities from a property store **70**.

5   The matching process **64** is coordinated with a scoring process
73 to sort and assess person or property data for the campaigns.
The matching process ensures that data received from the user
interface via virtual workers can be matched to persons in the
person store **68** and/or properties in the property store **70**.

10   There are several types of scores generated for different
campaigns by the scoring process **73**. An agent eligibility score is
used to categorize agents according to recent performance. A
listing score and sales score are derived for properties based
showing how likely they might be to be listed or sold. Potential

15 customers obtain a contact priority score based on the recency,
frequency and cost of contacts to date versus their sales revenue
potential. Potential customers are also assigned to a home buying
or selling readiness state estimating how likely they might be to
buy or sell a house. In all cases scores are derived from user

20 supplied rules for interpreting survey questions or market
behaviors. These rules are supplied by the user to particular
campaign via the respective virtual worker interface. Scores may
also be derived from the prediction engine **22** to generate a
predicted score. Currently, this is embodied by the use of

25 holographic neural net technology to enfold patterns of actual data
to predict scores based on historical results

    After matching and scoring have been done, the optimization
engine **24** is utilized. The optimization engine **24** is currently
embodied via an exchange process based on genetic algorithm and

30 game theory techniques described below. In the optimization engine
exchange process, a software version of a "free market" is created
where any objects in this system (e.g. slots in a call queue,
positions in a mailing list, houses for sale, agents, services,
etc.) may enter the exchange as either "buyers" or "sellers". The

35 exchange allows the software objects to create bids and make deals
in an iterative process that trades-off individual best deals
against the aggregate set of deals in order to come as close to the
campaign sponsor's goals as possible. Bids are generated based on
bidding algorithm rules, targets, and budgets supplied by the user

40 via virtual worker interfaces **62**, **63**, **54**, **58** to the appropriate
campaign. The bidding algorithm rules provided by the user
essentially weigh the matching process **64** criteria for desires **66**,
and the relevant scoring process **73** generated scores, in order to
create a bid that optimizes the user's goals.

45   Using the same hotline example as cited previously will
illustrate this approach. Members of the public call the broker's
hotline. This broker asset is managed by instance of a (inbound
hotline) campaign **50** and campaign management process **51** which
carries and executes the appropriate rules, targets and budget

50 definitions. The virtual marketing director **54** obtains these rules
from the broker **52**. The matching process **64** takes each hotline

call's detail (caller id, call flow details, properties listened to
by the caller, etc.) and matches respective persons in the person
store 73, desires in the data store 66 and properties in the
property store 70. Having done so, the scoring process 73 generates
5   a contact priority score for each caller, a home buying or selling
readiness state score is also calculated based on previously
supplied rules. The prediction engine 22 submits to a properly
trained holographic neuron the call detail for the caller, and a
predicted home buying or selling readiness state score is derived
10 based on historical data. A software object representing this
hotline caller now goes to the optimization process 24 exchange as
a "seller". It "advertises" its availability on the exchange.
Specifically, it advertises that it is available with a certain set
of scores. The broker 52 has also created another (outbound
15 telemarketing) campaign 50 to manage the process of calling out to
prospective leads from the public 60 to obtain qualified referrals
for agents 56. This outbound telemarketing campaign was also set up
via the virtual marketing director 54.
      The call center can only make so many calls to the public per
20 day. This total constitutes a call queue. The slots in this call
queue go to the optimization engine 24 exchange as "buyers". Slots
at the top of the call queue (i.e. the calls to be made earliest in
the day or by the best customer service representatives) are
allocated a larger budget by the campaign sponsor to obtain the
25 most qualified leads. The budget, rules for bidding and any
specific targeting goals have already been supplied via the
definition of the outbound telemarketing campaign and the virtual
marketing director 54.
      In the exchange process, all buyers (call queue slots) get to
30 bid on all sellers (hotline callers with scores) in such a way as
to allow the best possible individual deals (lowest cost for best
deal) as well as the aggregate set of deals (not exceeding some
total budget). Thus, deals between buyers and sellers may be
pending until all buyers and sellers have been through the process
35 enough times that overall goals are met. The optimization process
is an iterative one and involves far more capabilities than any
sequence of sorts or matches could produce. The overall process is
similar to that obtained with genetic algorithms; a population
(buyers and sellers) is allowed to interact in multiple ways until
40 local and global optimization takes place (i.e. best individual
deals and best aggregate set of deals). In contrast to genetic
algorithm models however the possibility of collaboration exists
between buyers and seller in the exchange process, and in this
sense the current system employs a technique that is enhanced by
45 game theory and software agent interaction protocols. The end
result is that the inbound campaign managing the hotline interacts
with the outbound telemarketing campaign managing the call center
to achieve the optimum list of hotline callers to call back the
next day.
50   This capability can provide for a plurality of campaigns for
all classes of users. For example, agents 56 can interact with

virtual personal assistants 58 to set up customized self-optimizing
campaigns for their listings which automatically allow all
prospective buyers to compete in the exchange for a chance to be
contacted by that agent's campaign. Similarly, members of the
5 public 60 can set up self-optimizing campaigns for marketing their
own house which automatically allows all prospective marketing
services (classified ads, postcards, telemarketing, use of an
agent, etc.) to compete in the exchange for the available budget
dollars. A broker 52 can use the system to set up a campaign to
10 obtain the optimum list of agents to recruit to work for the
broker. In such a broker recruiting campaign, software objects
representing those potential agent recruits from competing brokers
would go the exchange scored by productivity history, markets
served, age, credentials, etc. They would compete for the chance
15 for the broker to contact them and be invited to join that broker's
firm. In addition, the actual compensation plan for existing and
recruited agents can be managed by another broker campaign that
optimizes those plans to improve margins by improving productivity.
     Referring to Figure 3, this use case diagram of a simple or
20 minimal version of the presently preferred implementation shows how
the invention might be deployed in a typical residential real
estate brokerage environment that includes a telephone hotline, a
direct mail fulfillment shop, a customer service representative
call center and an internet web site.
25   The computerized marketing system itself is shown at 102. The
real estate brokerage hotline computer 104, direct mail fulfillment
shop 106, internet web site server computer 116, and customer
contact center representative at 118 all serve to allow members of
the public 108 to communicate with the computerized marketing
30 system. In the case of the internet web site, this data would be
input through the public object 60 of the computerized marketing
system via a virtual agent 62 directly connected to the
computerized marketing system. In the cases of the contact via the
hotline or a direct mail campaign response, data from computers
35 managing these assets is passed to the computerized marketing
system via network connections. In the case of contact via live
phone call with the customer service representative (CSR), data
is entered by the CSR through use of the virtual CSR 63 over a
network which constitutes an brokers intranet 110.
40   Such an Intranet also constitutes the means to connect agents
and broker's employees to the computerized marketing system. Agents
114 would interact with virtual personal assistants (virtual PA's)
58 over the Intranet. Marketing directors 112 would interact with
virtual marketing directors (virtual MD's) 54 also via this
45 Intranet.
     Figure 4 illustrates the potential customer referral
generation process as performed by the preferred embodiment of the
computerized marketing system previously described. This same
process is available to use by the broker to handle agent
50 recruiting as well. It illustrates the key components available by

cascading campaigns together to achieve optimization of larger business processes.

Figure 4 is a data flow diagram showing how referral data is generated and processed by the software components of the system.
5 The referral generation process involves both inbound and outbound campaigns. In Figure 4, the components involved primarily in the inbound campaigns are shown generally at 130. Any number of different inbound campaigns can be active at any given time. Thus in Figure 4 several different inbound campaigns have been
10 illustrated (i.e., hotline, open house, seminar, direct mail, Internet). These assorted inbound campaigns communicate with the inbound campaign component 132 that supplies data to create an aggregated set of contacts 134 from all the inbound campaigns. These contacts use the services of the HNet holographic neural
15 network prediction engine 22 to generate predicted scores for home buying and selling readiness state to complement the scores calculated via the scoring process 73 as described previously. The optimization engine 24 component spawns a telemarketing exchange process 136 component. It receives scored contacts 134 and analyzes
20 the data to determine which of these optimum contacts would be best handled by mailing list and which would be best handled by direct telephone call. Note that the inbound CSR telemarketing campaign component 142 may also directly supply contact data to component 138. Recall that the inbound CSR process is handled by the virtual
25 CSR 63. The exchange process component 136 thus routes the respective contacts data to the call candidate's component 138 and to the mail list candidate's component 140 based on this determination. It also optimizes the sequence of call candidates for the Outbound CSR TM (telemarketing) Campaign 152 exactly as
30 described previously for the Hotline in the discussion regarding the optimization engine and exchange process. The only difference is that the overall referral generation process described in Figure 4 combines all inbound campaign leads from all inbound sources into one exchange process allowing all potential leads to compete for
35 call backs or mailings. The mail list candidates may be further optimized using the direct mail exchange process component 142. This component will either cause outbound mail to be sent via outbound mailbox 144, or it will redirect less valuable mailing list candidates to the outbound direct mail campaign component 146
40 where they will eventually be combined with future contacts to again compete for an opportunity to be assigned to an outbound campaign. In general, the direct mail campaign will be initially structured by rules, target and budget information supplied through the virtual marketing director agent 54 or through the virtual
45 personal assistant agent 58

Outbound call candidates, routed to component 138, are forwarded to the outbound CSR telemarketing campaign component 152 to administer the desired campaign. In this case, CSR's 118 contact the optimized leads that have populated the call queues to
50 ascertain which ones are ready to buy or sell a property and

agreeable to working with the brokers agents (or affiliate agents) to do so.

    The computerized marketing system treats the referral of leads to the real estate agent as an outbound campaign directed, not to
5 members of the public, but to the real estate agents themselves. In Figure 4 the components primarily responsible for the referral campaign are shown generally at 154. Note that the prediction engine 22 operates upon referrals stored in the referrals component 156 and that multiple feedback loops 158 and 160 are provided to
10 allow the system to be self-tuning. More specifically, call candidates supplied from the outbound CSR telemarketing campaign components 52 are supplied to the referral campaign component 153, which in turn stores referrals in component 156. The referral exchange processing component 162 extracts optimum agent referrals
15 and supplies them to the appropriate agents designated at 164. In the preferred implementation, these sales leads would be supplied as qualified referrals through the virtual personal assistant agent 58.

    Feedback regarding the status of these forwarded referrals
20 does not have to rely on the agent's co-operation in providing status updates. The broker Pend system component 168 identifies which referrals have become actual customers of that agent and that broker. A component that connects to existing multiple listing systems (MLS's) 166 allows the computerized marketing system to
25 determine - if a referral to an agent became a customer of a different agent or broker.

    This feedback loop allows the prediction engine 22 to learn to predict which leads actually are likely to become referrals and customers and which CSR's should work with which leads as shown at
30 22 and 134. Similarly, the prediction engine can also use this feedback loop to predict which referrals are most likely to be customers and which agents would be best matched to those referrals at 22 as shown at 22 and 156.

    Thus Figure 4 illustrates both the referral process and the way
35 this process implements feedback loops that enable the computerized marketing system to learn patterns over time to improve performance beyond what user-supplied rules alone can achieve.

The Object-Oriented Business Modeling Framework

The computerized real estate marketing system may be
constructed using a number of different programming models. The
5   presently preferred implementation is constructed on an object-
oriented model, organized around a business modeling framework that
hierarchically organizes business objects into three major sub-
classes, namely an organization class, a process class and a
resource class. Each class may have a plurality of instances of
10   objects within that class (i.e. multiple resource objects in the
resource class). This framework is illustrated in Figure 5, which
is included here to acquaint the reader with concepts that may be
employed in developing a preferred embodiment of the invention. For
more information regarding this approach to a business modeling
15   framework, see "Business Engineering With Object Technology," David
A. Taylor, John Wiley and Sons 1995.

Although object technology will be described here, it should be
understood that the present invention can be implemented using
other programming techniques, and need not be based on the business
20   model framework shown in Figure 5. More specifically, the current
implementation is a modified form of the business element framework
shown in Figure 6. Figure 6 illustrates the business element
object 80 as a top node and broken down into individual classes of
objects: organization objects 82, process objects 84 and resource
25   objects 86. These individual classes of objects are in turn
subdivided into subclasses of objects that will be described more
fully below.

Accessible by any business element (i.e., any organization
object, process object or resource object) are a set of utility
30   objects 90. For convenience, these utility objects are shown under
a separate node at the same hierarchical level as the business
element node. The utility objects include scheduler object 92,
recorder object 94, rules object 96 and a neural network object 98.
The presently preferred embodiment uses holographic neural network
35   technology (HNeT). The neural network object comprises the
prediction engine 22 as illustrated diagrammatically in Figure 2.
Although other types of prediction engine technology may be used,
the current embodiment uses holographic neural technology that
employs associative memories utilizing confidence-mediated
40   associations as described in U.S. Patent No. 5,214,745, entitled
"Artificial Neural Device Utilizing Phase Orientation in the
Complex Number Domain to Encode and Decode Stimulus Response
patterns" and U.S. Patent No. 5,515,477 entitled, "Neural
Networks," both by John Sutherland. For further information on
45   holographic neural network theory, see "fuzzy, holographic, and
parallel intelligence, the sixth-generation breakthrough," Soucek,
Branko, Chapter 2, pages (9-92) John Wiley and Sons, 1992.

Figure 6 illustrates how objects can be hierarchically defined
to build the system illustrated in Figures 2 and 3. Some of the
50   dynamic behavior of the current embodiment may be seen from Figures
7 and 8. Figure 7 illustrates the referral generation batch

process as an event trace diagram. Figure 8 shows a similar event
trace diagram for the inbound CSR telemarketing call processing.
In Figures 7 and 8 the computerized marketing system is referred to
by the acronym CARS (customer acquisition and retention system).
5   In Figures 7 and 8 the vertical lines are labeled at the bottom to
correspond with different components or objects within the system.
Messages are passed between components or objects to effect the
referral generation and inbound CSR telemarketing call processes.
In general, time flows from top to bottom in these figures. Thus,
10   in Figure 7 the process begins with the user requesting through a
virtual systems administrator interface (SA) that the computerized
marketing system (CARS) be started. This request may be relayed
through a system department interface to the CARS system, itself.
The computerized marketing system (CARS) is preferably configured
15   to initiate a customer acquisition process which in turn triggers a
batch referral generation process by sending an appropriate
message, designated at 200 in Figure 7, to the batch referral
generation (RG) process.
     The batch referral generation process then determines its
20   current operating state through a series of messages with the
inbound referral generation campaign process, as depicted at 202.
This entails checking with the inbound RG campaign process to
determine if there are any unprocessed contacts pending and by then
requesting the inbound RG campaign process to execute a person
25   contact process for each contact pending. This, in turn, triggers
the person contact process to obtain various information as
illustrated at 204 generally pertaining to contact data about the
person to be contacted. When all contacts have been processed in
this fashion, the person contact process sends a message at 206
30   informing the batch RG process that all contacts have been
processed. The batch RG process then sends a message to the
inbound RG campaign to execute a follow up.
     As another example of the dynamic behavior of the computerized
marketing system another process is documented in Figure 8. The
35   inbound CSR telemarketing call process proceeds through a series of
messages between modules or objects, in a fashion similar to that
described in Figure 7. The process illustrated in Figure 8 is
exemplary of the manner in which the other major interfaces work
within the system.
40   The present invention can be deployed in a variety of different
hardware configurations. Figure 9 illustrates one example of a
suitable hardware configuration. The data used by the computerized
real estate marketing system may be stored on a main database
server 200, having a person database 201 and a property database
45   202 for storing records relating to all relevant real estate
markets being handled by the system. In large-scale applications
computer 200 may be a mainframe or large file server computer.
Computer 200 is connected over a corporate backbone network 203 to
an application server 205 that handles the business logic for the
50   computerized marketing system. The application server 205 in turn
is also connected by corporate network to a web server which

handles allows all users to access the system via standard web
browser software. As illustrated, a corporate Intranet client **210**
accesses the system locally with a web browser. Offices Intranet
clients **225** access the system via a corporate wide area network
5 (WAN) **220**. Dial-in Intranet clients **212** access the system by
reaching the Internet. Members of the public access the system via
a public web site as Internet clients.

Because the computerized marketing system assumes only web
browsers for clients, it makes very modest demands on the type of
10 device the clients (agent, employee or member of public) uses. PC's
and NC's, laptops, PDA's, etc. can all be used as well as most
operating systems for these devices.

In addition, the use of a three tier architecture with web
(TCP/IP) protocols and open (CORBA) middleware allows the system to
15 be deployed by many different brokers whose local systems can not
only communicate with one another, but conduct business across the
web. Specifically, objects from one broker's system can move over
the web to another broker's system and participate in the exchange
optimization process in that broker's market.

20 Thus the current design can conduct business across a community
of brokers with the appropriate objects seamlessly migrating from
one market to another. An example would be the ability of a local
broker to host an exchange where buyers from many markets compete
to obtain properties or services in that local market. This
25 computerized marketing system is a superset of current multiple
listing systems, broker or agent web sites, relocation and referral
networks and BackOffice transaction systems. If deployed by
multiple trading partners, it is capable of operating as a single
unifying electronic commerce environment for commerce within
30 residential real estate or similar consumer marketing industries
using any combination of selling modes (i.e. independent agents,
contract sales force, no sales force, etc.).

An Object Model for the Customer Acquisition and Retention
Svstem (CARS)

35
In designing a customer acquisition and retention system (CARS)
according to the principles of the invention, it can be helpful to
construct an object model. The object model records the designer's
current understanding of the scope of the system and is used to
40 extend the model and to fix oversights as development of the system
proceeds. An exemplary object model is described here. The object
model described here is intended to teach concepts useful in
practicing the invention. The object model presented here is not
intended as a limitation of the invention in its broader aspects.
45 This object model presented here is an analysis model. The goal
of analysis is to specify what needs to be done, not how it is
done. During analysis we specify the object structure of a customer
acquisition and retention system that is implied by the
requirements. Analysis is a difficult task in its own right, and we

must fully understand analysis before we can handle the additional complexities of design.

During design we transcend the direct implications of the requirements and decide how to realize deep functional goals. The full implementation of CARS will have additional objects that are not specified in the analysis object model.

As an example of the distinction between analysis and design consider the notion of an exchange. An exchange can be used to match listings and obtain deals. An exchange is not an analysis construct but is appropriate during design. During analysis we note there are potential buyers and sellers of properties and services and that they must be matched in some way. During design we specify how matching occurs..

Note that we have organized our object model into packages. A package is merely a collection of classes, associations, and generalizations with a common theme that is convenient for presentation purposes. Each association and generalization appears in a single package. A class may appear in multiple packages and provides the means for binding packages. When a class appears in multiple packages, we define it in one package (and show its attributes and operations). In all other packages we merely reference the class (shown by suppressing its attributes and operations).

CARS is a ambitious application. Not surprisingly, the object model presented in this document is also complex. Specifically, the following technical aspects contribute to the complexity of the CARS model: metamodeling, historical data, dynamic behavior, and broad scope.

We have taken care to avoid multiple inheritance in this model. Multiple inheritance is confusing to understand and awkward to implement with a relational database.

1. Market Agent

Figure 10 describes market agents. We will start by explaining the LegalEntity class. A legal entity is an organization or a person. We use the name legal entity because both organizations and persons have legal standing in the real world. All three classes (Organization, Person, and LegalEntity) are prominent and referenced in other portions of the CARS model. In particular, we reference the LegalEntity class for tasks that can be fulfilled by an organization or a person.

A person can work for multiple organizations and an organization can have multiple persons working for it. We have promoted this relationship between persons and organizations to a class in its own right (Remuneration). Then we can keep historical data: past job titles and past organizational affiliations. There are various remuneration types such as employment (employer-employee) and contracting (client-contractor).

The jrSr attribute in the Person class indicates whether a person's name has a suffix such as Jr., Sr., II, or III. A person may have a professional title such as PhD., DSc., or M.D. A person

may have a preferred salutation such as Mr., Dr., Mrs., Ms., and
Miss. A person would ordinarily belong to a single household, but
it is possible for a person to belong to multiple households, given
divorce, remarriage, and other lifestyle arrangements. It is
5   important to be able to track the members of a household because
knowledge of a household may be relevant for the sale of real
estate. A person may fulfill some role in a household, such as
husband, wife, son, and mother-in-law.
    A real estate board (such as the National Association of
10 Realtors and a Multiple Listing Service) is staffed by multiple
organizations and an organization can belong to multiple real
estate boards. Ordinarily only realty firms would belong to a real
estate board, but the model does not enforce this constraint.
    We show an aggregation relationship on organization. An
15 organization can consist of lesser organizations, which in turn can
consist of even smaller organizations. This decomposition of
organizations can occur to an arbitrary depth. Thus, for example, a
company can have multiple divisions, a division can have multiple
departments, and a department can have multiple offices. Some
20 possible values for organization type are: company, division,
department, and office.
    Moving up the inheritance hierarchy, a market agent can be a
legal entity or a computer agent. Computer agents can assist
persons and organizations; the resulting productivity enhancement
25 is part of the promise of CARS. The notion of a market agent is
also prominent in CARS. We reference the MarketAgent class for
tasks that can interchangeably be fulfilled by an organization,
person, or automation. Our model is intended to be flexible and
accommodate an evolving trade-off between work that persons and
30 organizations must perform and that which can be handled by
automation. Thus in the near future, the model (and corresponding
database) can record manual tasks. As CARS becomes more
sophisticated, the database can transition to tasks being performed
by computer agents.
35   The top portion of Figure 10 shows a metamodel for representing
the attributes of market agents and their values. Ordinarily we
would use generalization to show the different kinds of market
agents and their attributes. However, such a generalization is
troublesome for CARS, because the same market agent could belong to
40 multiple subclasses (overlapping multiple inheritance). Thus 'a'
person who is the real estate broker market agent may buy a house
in one deal, sell a house in another deal, and be a realty agent
for other deals. Overlapping multiple inheritance is confusing to
understand and difficult to implement, so we have avoided it.
45   Instead, we capture the information with a metamodel. There are
many types of market agents, including marketing director, realty
agent, customer service representative, customer service director,
seller, buyer, builder, financier, loan officer, realty firm, and
system administrator. (We include system administrator for
50 convenience, although this market agent type does not seem directly
germane to the objectives of CARS.) Each market agent may handle

the responsibilities of any number of these types. Conversely, each
market agent type applies to multiple market agents.

We call the combination of MarketAgentType and MarketAgent a
MarketAgentRole. MarketAgentRole is also referenced elsewhere in
5   the CARS model. Note that a market agent can fulfill a role more
than once. For example, a person can be searching for two pieces of
property and be in different states for buying each piece of
property.

A market agent type has certain attributes that apply. Table 1
10 lists some sample attributes. The eligibility score measures the
business effectiveness of a realty agent: the degree to which they
follow-up on leads, their willingness to interact with CARS, the
degree to which leads are converted into deals or lost to
competitors, and the extent of positive customer feedback.

15 The contact priority score is calculated based on cost of
contacts to date, recency of contact, frequency of contact, and
potential value as a buyer or seller. This score will be used to
prioritize resources and determine the organizations and persons
most favorable for further efforts.

20

MarketAgentType	MarketAgentAttribute
RealtyAgent	currentYearRevenue
RealtyAgent	currentYearProfit
RealtyAgent	currency
RealtyAgent	specialty
	(first time buyer, relocation, ...)
RealtyAgent	eligibilityScore
Seller	annualSalary
Seller	currency
Seller	creditRating
Seller	contactPriorityScore
Buyer	contactPriorityScore

Table 1. Some MarketAgentAttributes

35 The association between MarketAgentType and
MarketAgentAttribute captures constraints -- the attributes that
are valid and apply for the various types of market agents. In
contrast, the association between MarketAgent and MarketAgentValue
stores the actual data -- the values for each market agent
40 corresponding to the attributes. The model (and corresponding
database schema) does not force the links between MarketAgent and
MarketAgentValue to be consistent with the links between
MarketAgentType and MarketAgentAttribute even though that is our
intent. Programming code in the final CARS software would have to
45 enforce the dependency between values and constraints which is
shown by a dotted arrow in Figure 10.

Some attributes have a list of permissible values. We store
these values with the EnumerationValue class. For example, the

specialty for a RealtyAgent has specific permissible values that
include first time buyer and relocation. The CARS software would
have to enforce that all MarketAgentValues exist in the list of
enumeration values, if enumeration values were specified for a
5   MarketAgentAttribute.
    With this metamodel we store all MarketAgentValues with a
uniform data type of string. The CARS software must consider the
data type of an attribute (string, integer, money, number, etc.) so
that it can appropriately format the value for display to users.
10   The metamodel is flexible. We can readily define new market
agent types and their attributes. Given this context, the CARS
software would let the database store appropriate values for the
corresponding market agents.

2. Property and Service

15   Figure 11 describes properties and services. A property is land
or a building that may be subject to a real estate transaction. A
service is some valuable consideration relevant to the real estate
industry. Some customers do not want a traditional realty agent.
However, they may be willing to pay the real estate broker for the
20   service of advertising their house. Other services could be
handling closing paperwork and screening property renters. We can
track the rental history for a property.
    A property may have a propertyType (residence, business, or
investment), zoning information, school district, tax information,
25   and graphic pictures for display on a screen. For extensibility we
are storing the currency for all financial values. Given the broad
scope of CARS and the ambitions of Insignia we believe it is likely
that multiple countries and currencies could be encountered.
A property may be land or a building. Attribute parkingType is an
30   enumeration with values that include carport, 1 car garage, 2 car
garage, and 3 car garage. Attribute buildingStyle also is an
enumeration with values that include A frame, split level,
colonial, and contemporary.
    A building may have multiple rooms for which data is stored.
35   Some possible values for roomType are: living room, dining room,
family room, kitchen, bedroom, den, workshop, laundry, office, and
basement. The attribute dimensionUnit refers to the units of
measure for the small and large dimensions of a room. In the United
States, room dimensions are normally measured in terms of feet.
40   We generalize property and service into ValuableItem. A
valuable item may have data computed by CARS as of some date such
as probability of listing and probability of being sold. (The slash
'/' in front of these attributes indicates that they are computed
and are not fundamental information.) Currently properties and
45   services are the only items relevant to CARS, but we could readily
add subclasses to ValuableItem for a broader business need.
    A valuable item may be a real property or real service, or it
may be a hypothetical item that a prospect desires. A valuable item
may be owned by multiple legal entities and there may be a history
50   of ownership. A valuable item may have multiple mortgages that are

ordered by their lien priority. A mortgage is provided by some
lender (a legal entity) and has one or more borrowers (legal
entities) responsible for servicing the debt. A title and mortgage
origination officer may also be noted. (The notion of a deal in
5   Figure 13 lets us record past selling prices for a valuable item.)
    There is almost an unlimited amount of information that we
could record about valuable items. It is difficult to tell which
data will be important to CARS and which will be peripheral.
Consequently, we have abstracted our representation for
10 miscellaneous data. A valuable item may have any number of pieces
of data stored, each of which are bound to the appropriate valuable
item attribute. This representation can handle multi-valued
attributes. For example, there could be several values of the color
for a house.
15   CARS is intended to support different market segments (also
called brands). For example, the do-it-yourself or self-serve brand
is intended to be low cost and gather business from the for-sale-
by-owner market. Traditional real estate services are another
brand. A third brand appeals to high-end customers and offers a
20 team-based, enhanced service. The object model captures the
positioning of valuable items into market segments.

3. Campaign

    Figure 12 presents an object model of the *Campaign* package. A
campaign is a coordinated set of activities that attempt to marshal
25 resources in such a way as to maximize the chances of the campaign
sponsor's desires being met while minimizing the cost to do so. For
example, a broker would like to create the largest pool of well
qualified referrals at the least cost. A buyer might like to find
the right house with the least expenditure of time and energy. A
30 seller's agent would like to help the seller's house get sold with
the least expense in marketing and the shortest days on market.
    A campaign may be inbound (responding to customer inquiries) or
outbound (initiating contact with customers). A campaign has a
name, start date, end date, budget, currency, and comment. A
35 campaign may be active or suspended by CARS. Campaigns are
characterized by grouping them into several types. Table 2 shows
some examples of campaign types. One of more market agents may
sponsor a campaign, providing authorization and assuming
responsibility for its budget. Campaigns may be hierarchically
40 structured; broad campaigns may be divided into lesser campaigns
with more focused activities. The *RelatedCampaign* association lets
us bind inbound campaigns to outbound campaigns.
    Campaigns are orchestrated to achieve objectives. The first
paragraph in this section illustrated several possible objectives:
45 find leads, buy property, and sell property. Variables are
manipulated to accomplish campaign objectives. The first paragraph
also demonstrated several variables: cost, time, and effort.
    Campaigns can involve several activities. A *campaign activity*
is some task that consumes resources in an attempt to market
50 services and properties and further the goals of one or more

campaigns. When an activity is beneficial to multiple campaigns, its costs must be allocated for accounting purposes. Various market agents can participate in a campaign activity and assume multiple roles.

5   A campaign activity has a name, start date, end date, budget, currency, and comment. We also indicate if a campaign activity is for indirect purposes, such as to publicize and raise the profile of a realtor, realty firm, or some other market agent role. Campaign activities are also grouped into several types: hot line, 10   direct mail, direct call, web site, advertising, and other. For example, the DirectCall class authorizes phone calls by customer service representatives that lead to PhoneCall events (see Section 8). A campaign activity is targeted at some region. (Section 6 discusses regions.)

15

                        campaignType

                        market monitor

                        market appraiser

                        aged inventory

20   customer status

                        personal promotion

                        direct mail

                        customer survey

                        sell valuable item

25   purchase valuable item

Table 2. Some *campaignTypes*

   Both campaigns and campaign activities are performed to obtain leads. A *lead* is a possible request for properties and/or services 30   that The real estate broker can provide. We assign a priority to leads so that CARS can emphasize the most promising leads. When possible, we track the correspondence of leads to campaigns and campaign activities so the CARS optimizer and The real estate broker can make better business decisions. Each lead can concern 35   multiple legal entities as prospective customers. (Recall that a legal entity is an organization or person.) Some legal entity may be the primary source for a lead.
   A lead is ultimately referred to a market agent on behalf of The real estate broker. (Recall that a market agent can be an 40   organization, person, or computer process acting as an agent.) Only one referral for a lead may be in effect at a time. Referrals can be revoked if an agent is ineffective for some reason.
   Typically a lead is referred by CARS, but a customer service representative may sometimes need to override the recommendation of 45   CARS. Referrals can also be made to affiliates, such as mortgage companies. Of course a prospect can be the subject of multiple leads and a market agent can handle multiple leads.

4. Listing and Deal

Figure 13 presents our object model for the listing and deal package. The purpose of campaigns is to spawn leads. The better leads ultimately turn into listings and deals.

5 A listing is a proposition to buy or sell properties or services (typically one property or service, but it could be many). Each listing is handled by a primary agent and involves multiple market agent roles (including customers). A listing is a dynamic object and the state-event model describes its current state as well as

10 its valid states (see Section 8). A listing may have various prices that are posted over time. We record a range for listing price because some listings are hypothetical (desires) and a range better describes what a prospect might pay than a single price.

CARS publishes listings and financial offers that are received
15 over time. Offers may be accepted, rejected, or pending. (These are offer states; see Section 8.) For property sales listings only one offer can ultimately be accepted. However, multiple offers can be accepted for some rental property and services. Typically an offer is made by one market agent (person, company, or computer agent)

20 but a large offer could conceivably be made by multiple market agents acting in concert.

The purpose of leads is to generate listings. Similarly, the purpose of listings is to generate deals. Occasionally a lead may directly trigger a deal, but normally the property or service
25 (valuable item) must be formally listed and offers received before a deal can be struck. A deal is a contract between persons or organizations for properties or services. A deal also is a dynamic object and has states such as pending and closed (see Section 8). The commissions and fees for a deal are apportioned to the various

30 market agent roles (persons and organizations that participate as realty agent, realty firm, ...) that contribute to a deal and posted to the appropriate financial accounts. The compensation for a deal can be via cash, check, or credit cards; the use of credit cards would facilitate electronic commerce on the web for the do-
35 it-yourself market segment. Credit card types include Visa, Mastercharge, Discover, and American Express.

5. Address, Phone, and Email

In Figure 17 we flexibly handle addresses, phone numbers, and email addresses. An AddressableObject is anything that can have
40 addresses, phone numbers, and/or email addresses. A market agent or a property can have addressable object information. An AddressableObject pertains to a MarketAgent or a Property, but not both (exclusive-or association). This constraint is not readily expressed with the object model.

45 In a prior iteration of this model, we generalized MarketAgent and Property into AddressableObject. We removed this generalization to avoid multiple inheritance -- it is more fundamental to generalize Property into ValuableItem.

We associate AddressableObject with MarketAgent instead of
50 LegalEntity because we must handle email. In addition, it is

conceivable that a computer agent might appear to be real and have
a phone and address from the perspective of an interacting person.

We can store multiple addresses for an AddressableObject and
assign an addressType (such as headquarters address, mailing
5   address, physical address, home address, or office address) to each
use of an address. Similarly, we also can store multiple phone
numbers (such as phoneNumberTypes of office, home, cellular, pager,
and fax) and multiple email addresses (such as emailAddressTypes of
home and office).

10   The class AddressTernary denotes that we must have the three-
way confluence of AddressableObject, Address, and AddressType to
resolve an occurrence. This is because an AddressableObject --
Address combination may have multiple AddressTypes. For example, an
address for a company may be used for both the headquarters and
15   mailing address. Similarly, the class PhoneNumberTernary denotes
the three-way confluence between AddressableObject, PhoneNumber,
and PhoneNumberType. The class EmailTernary denotes the three-way
confluence between AddressableObject, EmailAddress, and
EmailAddressType. The arrows indicate the combination of objects
20   that are required to identify each occurrence of the ternary
association. (OMT has notation for ternary associations, but the
modeling tool that I used does not.)

An address may refer to postal code, carrier route, and city
data from which additional address details can be deduced.

25   **6. Geographic and Demographic Region**

Figure 14 defines a region as a geographic region, a
demographic region, or a combination of both. Figure 12 referenced
region to specify the scope of a campaign activity.

The generalization hierarchy specifies different kinds of
30   geographic regions. We also note dependencies between geographic
information. For example, a city belongs to a county which belongs
to a state or province which in turn belongs to a country. Thus in
Figure 14, if an address refers to a city, we can look up the
county, state, and country data.

35   There are two different bases for specifying geographic
regions: postal data (carrier route, base postal code, and extended
postal code) and census data (metropolitan statistical area, census
tract, block group, parcel, minor civil division, and enumeration
district).

40   Currently a demographic region is determined by prizm code.
However, other techniques for assessing the economic status of
households could also be used.

7. Business Element

Figure 15 shows the kind of objects that can inherit dynamic
45   behavior. Section 8 shows the corresponding model for state-event
models.

A BusinessElement can obtain rules from the user and execute
those rules. A Resource inherits the capabilities of
BusinessElement and can also compute its cost and revenue. We

presume there are additional classes that are BusinessElements, but
not Resources, though we have not determined them at this time. We
record these major operations for the BusinessElement and Resource
classes because they are important and not simply inferred from the
5   object model.
     Similarly, DynamicObject inherits from Resource. We presume
there are additional classes that are Resources but not
DynamicObjects.

8. State Model

10 The right side of Figure 16 presents our state-event metamodel.
Revision 1 of the CARS model had many examples of processes. It is
important that we be able to handle these processes, but ideally we
should not hard code them into the model's structure. The actual
processes that are used in CARS will change as our understanding of
15 the requirements mature and the business evolves. A better approach
is to store process information as data so it can be more easily
changed. Hence, we incorporate a state-event metamodel for process
information. The CARS software could include a state-event engine
to execute the processes stored in the database for the metamodel.
20 (We recommend a state-event interpreter or precompiler.)
     A StateType may have transitions entering it from another state
type or transitions exiting it for another state type.
Alternatively, a StateType may have a transition occur internally
while remaining in the state type. Transitions may be triggered by
25 an event type and/or a guard condition. A state may have processing
that occurs for all or part of its duration, or processing may be
executed in response to a transition. A DynamicObjectType has a set
of permissible states which together with the defined transitions
constitute a state diagram. The possible values for dynamic object
30 type are: lead, listing, offer, deal, the values of market agent
type, the values of campaign type, and the values of campaign
activity type (as embodied by the generalization in Figure 3).
The left side of Figure 8 shows individual states and events that
instantiate the metamodel. State and Event, respectively,
35 instantiate StateType and EventType in the state metamodel. A
DynamicObject may have a current state.
     An event is a specific occurrence and can be a phone call, a
meeting, email, written correspondence, or something else. An event
can involve multiple market agents (persons, organizations, or
40 computer agents) as well as multiple valuable items (services or
properties). An event may be stimulated by campaign activities. The
Event class lets us record interaction with potential customers and
apply the rules that are embodied in the state transition diagram.
     The state model lets us specify appropriate behavior in
45 response to the home buying readiness state (HBSR) of a prospect.
Furthermore, we can track the current state of a prospect and the
events that have transpired in the past. For example, the state
types of satisfied, twinkle, itch, and action would be appropriate
for market agent roles of potential home buyer and potential home
50 seller.

As another example, the state model lets us capture the life cycle for a house (vacant lot, improved, under construction, vacant house, occupied house, ...).

Appendix A. Sample Queries (Some Use Cases)

Here are some of the queries that the model (and the resulting database implementation) can answer.

We are recording these queries for several purposes: (1) to reduce oversights when constructing the model, (2) to show how the model can answer business questions, and (3) to facilitate implementation.

- How much of the budget of a campaign is consumed by campaign activities?
- How is a campaign budget apportioned to various zip codes?
- Are any current offers pending for a property?
- What are the top 10 accounts for fiscal year 1997?
- What value of offers was made in the past month for all properties and services?
- What percentage of offers were accepted in the past month for all properties?
- What realty agents had the lowest percentage of their offers accepted in the past month?
- What is the current listing price for a property?
- What is the average ratio of sell price to listing price for deals concluded in the past year?
- What deals can be attributed to a given campaign?
- Find all properties that do not have an offer.
- What is the home address and phone number for John Doe?
- What information does The real estate broker have for Jane Smith?
- Compute the average cost per lead (prorate the cost of the campaign that is its primary source).
- What was The real estate broker's market share for deals in a given zip code in a given year? (We can only answer this query if non-The real estate broker deals are entered in the database.)
- What was the average margin for deals in a given zip code in a given year?
- What customers have provided The real estate broker with repeat business in the last year?
- Find all properties listed in a city within a specified price range.
- What percentage of leads became listings in a time interval for a region and realty firm?
- What percentage of leads became deals in a time interval for a region and realty firm?
- What percentage of listings became deals in a time interval for a region and realty firm?

- How many days has a property been on the market?
- Find the hot line callers that a customer service representative (CSR) called back.
- Rate prospects for CSRs to call per outbound campaign rules.

5 **Appendix B. Brief Explanation of the Data Modeling Notation**

Figures 10 through 17 use the OMT object modeling notation which is a popular enhancement of the Entity-Relationship approach. Figure 18 summarizes modeling constructs that are encountered in this data model.

10   A class is denoted by a rectangle and describes objects with common attributes, behavior, and semantic intent. Campaign, Person, and Deal are examples of classes. Attributes describes values of the objects in a class and may be listed in the second portion of the class box. For example, campaignName, inboundOrOutbound,

15 activeOrSuspended, startDate, endDate, budget, currency, and comment are attributes of class Campaign. Operations are behavior that an object can perform and are listed in the third portion of a class box.

       Generalization organizes classes by their similarities and
20 differences and is denoted by a triangle. In Figure 10 a LegalEntity can be an Organization or a Person. Simple generalization apportions superclass instances (LegalEntity) among the subclasses (Organization, Person). Figure 10 states that a LegalEntity must be one of these two possibilities and that there

25 are no other possibilities.

       An association describes the relationship of objects of two or more classes and is indicated by a line. The adornment on each end of an association line denotes multiplicity. Multiplicity specifies how many instances of one class may relate to an instance of an

30 associated class. A solid ball means 'many' (zero or more); a hollow ball means 'zero or one'; a line without a multiplicity symbol means exactly one. In Figure 12 a Referral may be assigned to a MarketAgent; a MarketAgent may be responsible for several Referrals.

35   An association may be described by attributes that do not belong to the related classes. In Figure 12 a Campaign may have multiple CampaignActivities and a CampaignActivity may benefit multiple Campaigns. For each CampaignActivity we must allocate the portion of its budget charged to each Campaign.

40   A role is one end of an association and may also be named. A role is written next to the intersection of the class box and association line. In Figure 12 there are two associations between LegalEntity and Lead. In one, LegalEntity has a role of primarySource and in the other has a role of prospect.

45   Aggregation is a special kind of association and is denoted by a diamond on the aggregate end. In Figure 10 an organization may be composed of lesser sub-organizations. The diamond end of the aggregation relationship denotes the master organization and the other end denotes the lesser organizations.

Conclusion:

From the foregoing it will be appreciated that the present invention provides a sophisticated computer-implemented business management system. The system has been described both in general terms and with respect to a specific embodiment useful in real estate marketing.

While the invention has been described in its presently preferred forms, it will be understood that the invention is capable of certain modification and that the concepts disclosed herein can be embodied in a variety of different ways without departing from the spirit of the invention as set forth in the appended claims.

We Claim:

1.   A   computer-implemented   self-optimizing   marketing
system comprising:
    a campaign engine for selectively generating and storing
a campaign population, said campaign population having members
5   comprising   stored   first   data   representing   a   plurality   of
marketing campaigns each campaign characterized by a plurality
of campaign attributes;
    a customer population data store for storing a customer
population, said customer population having members comprising
10   stored second data representing a plurality of customers and
potential customers, characterized by a plurality of customer
attributes; and
    an   optimization   engine   for   accessing   said   first   and
second   data   to   optimize   at   least   one   of   said   campaign
15   population and said customer population,
    said optimization engine including a scoring system for
ordering   the   members   of   at   least   one   of   said   campaign
population and said customer population, said scoring system
employing   adaptive   scoring   process   that   alters   said   scoring
20   process   based   upon   relations   among   at   least   some   of   said
campaign attributes and said customer attributes.

2.   The system of claim 1 further comprising an agent
population data store for storing an agent population, said
agent population having members comprising stored third data
representing a plurality of agents each agent characterized by
5   a plurality of agent attributes, and
    wherein said scoring system orders the members of said
agent population based upon relations among at least some of
said customer attributes and said agent attributes.

3.   The   system   of   claim   1   wherein   said   optimization
engine employs genetic algorithm.

4.   The system of claim 1 wherein said campaign engine
includes prediction engine and optimization engine.

5.   A computer-implemented marketing system comprising:
a state-event engine which manages behavior over time of
a plurality of dynamic objects in response to events in
deterministic fashion from user-supplied rules, wherein said
dynamic objects include:
a campaign engine for selectively generating and storing
a campaign population, said campaign population having members
comprising stored first data representing a plurality of
marketing campaigns;
a listing population data store for storing a listing
population of offers to buy and sell resource items, said
listing population having members comprising stored second
data representing resource items having associated offers to
buy or sell;
a matching process for ordering the members of said
listing population based on members of said campaign
population such that a set of both offers to buy and offers to
sell the same resource item is created.

6.   The system of claim 5 wherein said dynamic objects
further include:
a marketing agent population data store for storing a
population of marketing agents associated with at least one of
said resource items.

7.   The system of claim 6 wherein said population of
marketing agents includes at least one software agent.

8.   The system of claim 6 wherein said population of
marketing agents has members comprising stored third data
representing marketing agent types and marketing agent
attributes.

9.   The system of claim 5 wherein said dynamic objects
further include:
a resource population data store for storing a population
of resource items comprising fourth data representing resource
item types and resource item attributes.

10. The system of claim 5 wherein said resource items
are selected from the group consisting of real estate
properties, goods and services.

11. The system of claim 9 wherein said resource item
attributes include cost of an associated resource.

12. The system of claim 5 wherein at least one of said
dynamic objects has an interface for interaction via a
computer network.

13. The system of claim 5 further comprising scoring process mechanism for creating a uniform measure of value for applying to said resource items.

14. The system of claim 5 further comprising scoring process mechanism for creating a uniform measure of value for applying to said resource items based on rules specified by users identified from said listing population and said campaign population.

15. The system of claim 5 further comprising scoring process mechanism for creating a uniform measure of value for applying to said resource items based on a weighted combination of rule-based values and predicted values.

16. The system of claim 5 further comprising prediction engine that accesses said listing population data store and includes an historical database of previous actual and predicted resource listing values.

17. The system of claim 5 further comprising prediction engine that generates individual predictions with an associated confidence measure whereby individual predictions are weighted.

18. The system of claim 5 further comprising optimization engine that implements an automated exchange process between offers to sell and offers to buy.

19. The system of claim 18 wherein said exchange process is based on user-specified rules extracted from said first data.

20. The system of claim 18 wherein said exchange process is based on user-specified rules comprising a specificity score representing the degree of match between a first resource item attribute set corresponding to the buyer and a second resource item attribute set corresponding to the seller.

21. The system of claim 18 wherein said exchange process is based on user-specified rules comprising a specificity score representing an importance weight.

22. The system of claim 5 further comprising optimization engine that sequentially and iteratively orchestrates the manner of bid offerings and bid acceptance in an exchange process between offers to sell and offers to buy .

23. The system of claim 22 wherein said exchange process seeks the best possible bid for each resource item using a predefined rule set provided by a sponsor of the a campaign.

24. The system of claim 5 further comprising a prediction engine having an historical pattern data store and a means for automatically obtaining data to about consummated exchanges between buyer and seller to for updating said historical pattern data store.

25. The system of claim 24 wherein said prediction engine includes a scoring process that adjusts the weight given to predicted values to reflect increased confidence over time as the system is used.

26. A computer-implemented real estate marketing system to facilitate transactions among real estate agents, at least one real estate broker and members of the public, comprising:

a campaign engine for selectively generating a plurality of marketing campaigns each characterized by a plurality of campaign attributes;

at least one data structure for access by said campaign engine for the storing and retrieving of:

(a) said campaign attributes,

(b) rules representing user-defined objectives of the marketing system,

(c) customer attributes reflecting the readiness and desires of selected members of the public with respect to real estate, and

(d) leads corresponding to selected members of the public;

said campaign engine having an agent interface by which said real estate agents may specify and store rules to be reflected in at least one marketing campaign and by which said real estate agents may retrieve leads representing selected members of the public;

said campaign engine having a broker interface by which said real estate broker may specify and store rules to be reflected in at least one marketing campaign and by which selected ones of said stored campaign attributes may be retrieved and communicated to said broker;

said campaign engine having a customer interface for the input and storing of customer attributes;

said campaign engine having a prediction engine that accesses said data structure to predict, based on said customer attributes, how said campaign attributes and leads may be modified to improve conformance to said rules and to predict which selected members of the public are most likely to engage in real estate transactions, thereby making marketing campaigns more attractive to members of the public and generating leads for said real estate agents.
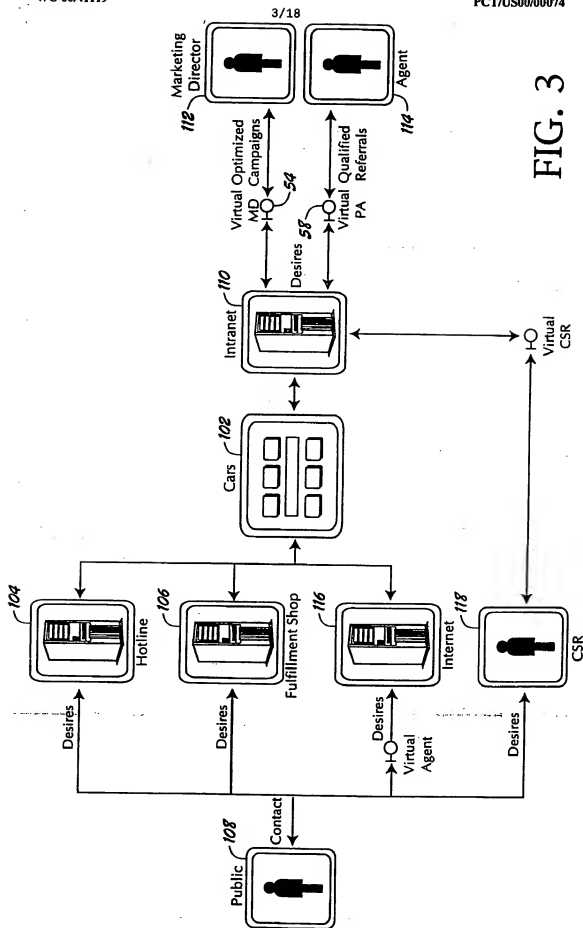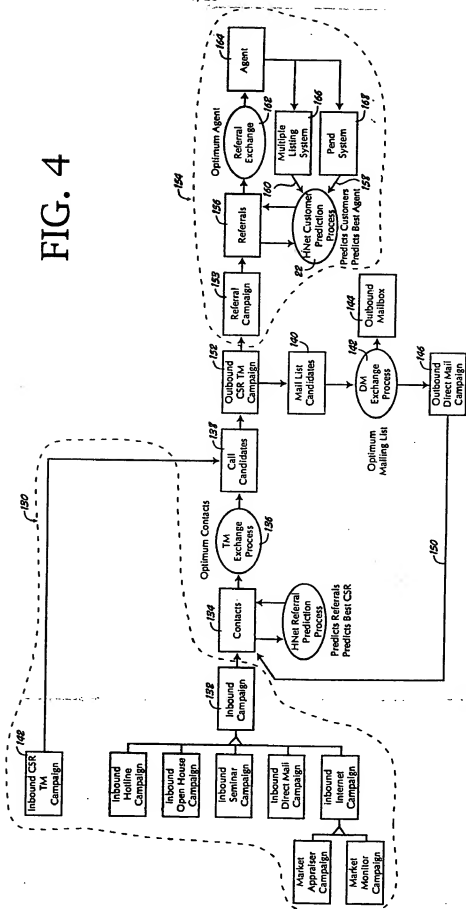
FIG. 1

FIG. 2

FIG. 3

FIG. 4

Business
Element

Organization   Process   Resource

─ Company   ─ Purchasing   ─ Human

─ Division   ─ Sales   ─ Facilities

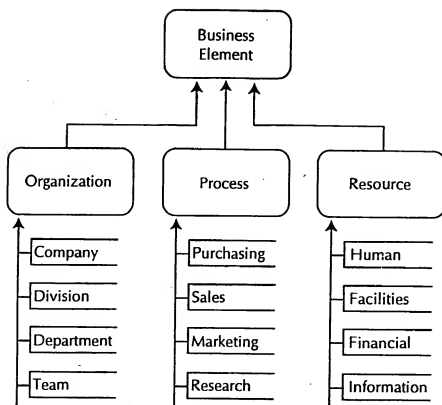─ Department   ─ Marketing   ─ Financial
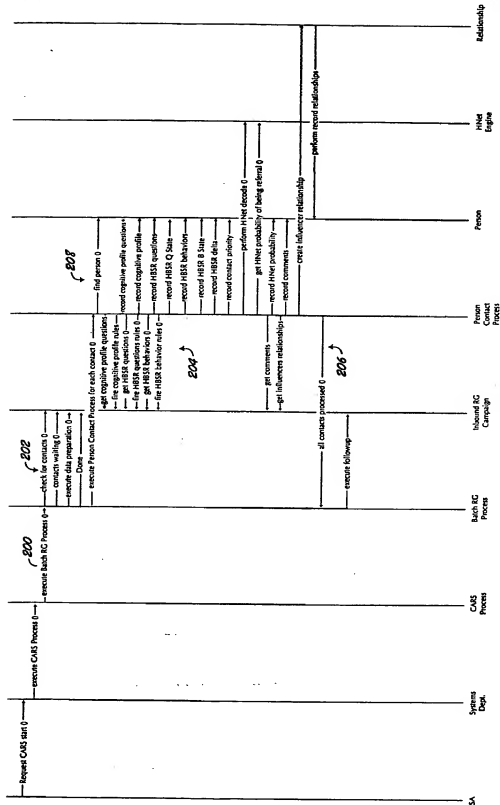
─ Team   ─ Research   ─ Information
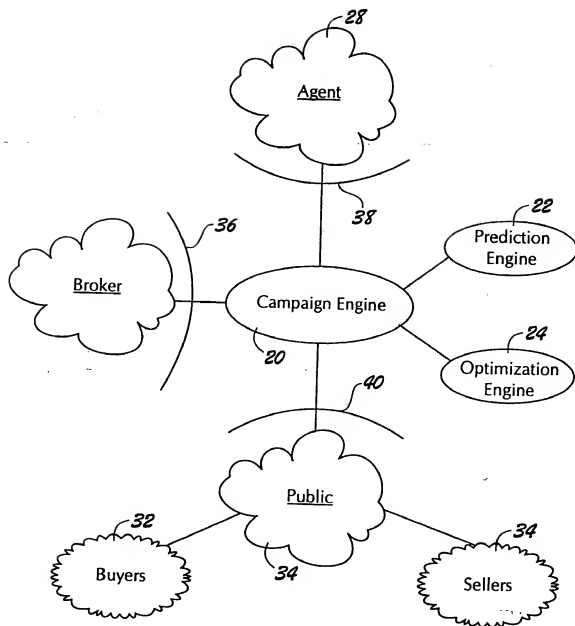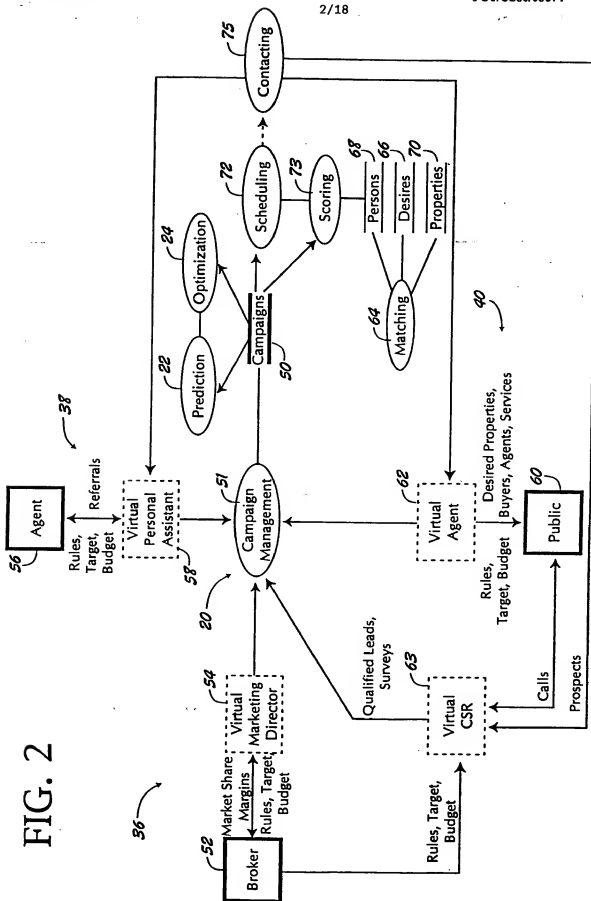
FIG. 5
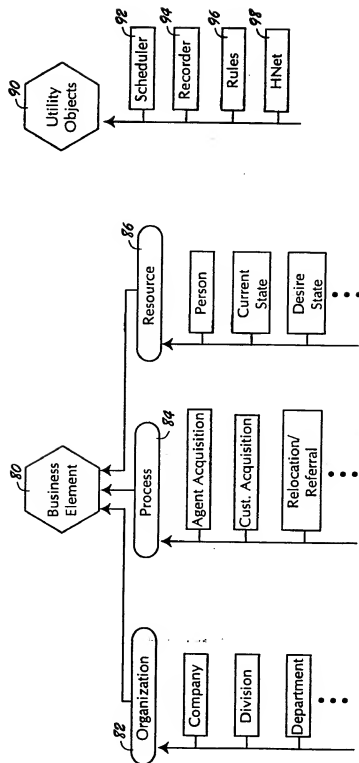
FIG. 6

FIG. 7

FIG. 8

FIG. 9

FIG. 10

EnumerationValue
enumerationValue
Comment

MarketAgentAttribute
attributeName
dataType
comment

MarketAgentValue
marketAgentValue
dateTimeOfLastUpdate

Household
householdName
comment

householdRole

Person
firstName
middleName
lastName
jr
nickname
professionalTitle
salutation
birthDate

MarketAgentType
marketAgentType
comment

MarketAgent
UserID
password
comment

ComputerAgent

Assists

LegalEntity

Remuneration
remunerationType
startDate
endDate
jobTitle
comment

MarketAgentRole

RealEstateBoard
readEstateBoardName
comment

Organization
organizationName
organizationType

MarketAgentType.MarketAgentAttribute specified the attributes that apply for each MarketAgentType.
MarketAgent.MarketAgentValue specified the values for each MarketAgent corresponding to the attributes.

FIG. 11

FIG. 12

FIG. 13

FIG. 14

FIG. 15

FIG. 16
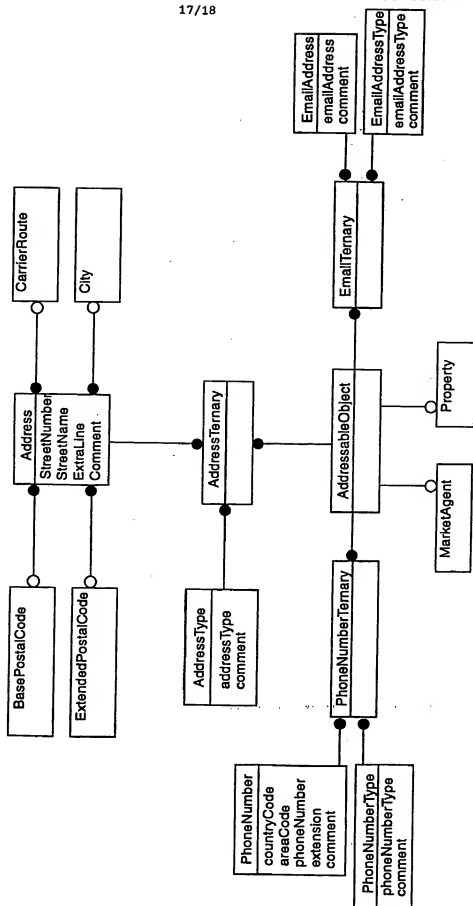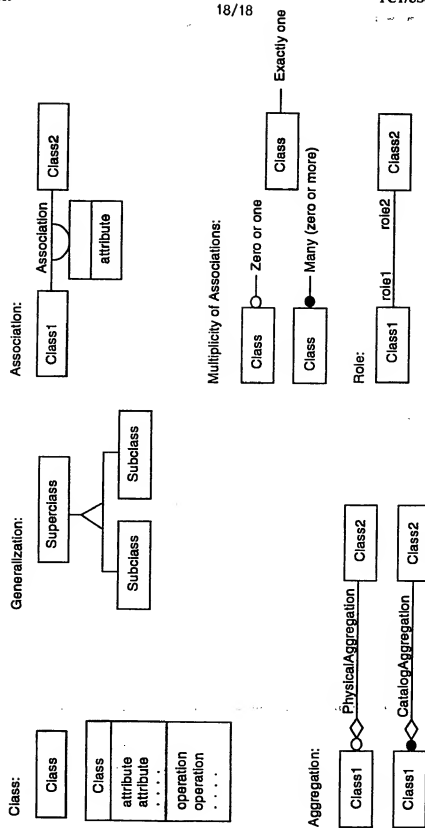
FIG. 17

FIG. 18

Class:

Class

Class
| attribute
| attribute
| . . . .
| operation
| operation
| . . . .

Generalization:

Superclass

Subclass

Subclass

Subclass

Association:

Class1 — Association — Class2

attribute

Multiplicity of Associations:

Class ○— Zero or one

Class — Exactly one

Class ●— Many (zero or more)

Role:

Class1 | role1 — role2 | Class2

Aggregation:

Class1 ◇— PhysicalAggregation — Class2

Class1 ◆— CatalogAggregation — Class2

A.   CLASSIFICATION OF SUBJECT MATTER

IPC(7)   :Please See Extra Sheet.
US CL   :705/10, 14, 26, 27, 37; 706/925

According to International Patent Classification (IPC) or to both national classification and IPC

B.   FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 705/10, 14, 26, 27, 37; 706/925

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

STN, DIALOG

C.   DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X, P --- Y, P --- A ---	US 5,930,764 A [MELCHIONE ET AL] 27 July 1999, Abstract, column 1, lines 62-67, column 5, lines 63-67, columun 6, lines 1-10, 52-55, column 8, lines 61-66, column 26, lines 58-59, column 62, lines 18-26	1, 5-12, 22-23, 26 ------- 3-4, 16-19, 24 ------- 2, 13-15, 20, 21, 25 -------
Y,P	US 5,970,064 A [CLARK ET AL] 19 OCTOBER 1999	3, 4, 16-19, 24

☐ Further documents are listed in the continuation of Box C.   ☐   See patent family annex.

* Special categories of cited documents	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	
"E" earlier document published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 MARCH 2000	**06 APR 2000**

Name and mailing address of the ISA/US	Authorized officer
Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	JAMES TRAMMEL
Facsimile No. (703) 305-3230	Telephone No. (703) 305-9768

Form PCT/ISA/210 (second sheet) (July 1998)*

A. CLASSIFICATION OF SUBJECT MATTER:

IPC(7)　　: G06F 17/60
US CL　　 : 705/10